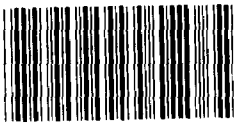
REPORT BY THE U.S.

General Accounting Office

International Response To Nuclear Power Reactor Safety Concerns

Sensitive information on some pages has been deleted because the Nuclear Regulatory Commission has determined that it is of a "foreign proprietary" nature and disclosure could seriously compromise the Commission's ability to obtain this type of information in the future.



GAO/NSIAD-85-128
SEPTEMBER 30, 1985

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

B-215047

The Honorable George P. Shultz
The Secretary of State

The Honorable Nunzio J. Palladino
Chairman, Nuclear Regulatory Commission

This report discusses the activities of international organizations, such as the International Atomic Energy Agency, to help prevent or mitigate the consequences of a nuclear power plant accident. It describes nuclear power reactor safety initiatives, including the sharing of nuclear safety information and efforts to establish a framework for an international response to an accident. We made this review as part of our continuing effort to assess the U.S. government's response to international nuclear issues.

Copies of this report are being sent to the Chairmen of the House and Senate Committees and Subcommittees having oversight responsibilities for the matters discussed in the report.

Frank C. Conahan
Director

The potential release of radioactive material into the environment from a nuclear accident has been a central issue in the debate on the future of nuclear energy. However, information on the frequency and nature of safety-related incidents at power reactors worldwide is not generally available.

The objective of GAO's review was to assess the information that is available as to the extent and seriousness of nuclear safety problems in other countries and what's being done internationally to help countries address these problems.

BACKGROUND

Although safety issues arise in all facets of the nuclear fuel cycle, this report focuses on the safety of the power reactors. About 300 nuclear power plants operate worldwide, representing over 3,100 reactor years of experience. Many of these plants have been operating for 15 years or longer.

According to the International Atomic Energy Agency (IAEA), a multilateral organization with a current membership of 112 countries, the overall nuclear safety record during the years has generally been good. However, the Three Mile Island accident propelled the questions of nuclear safety into worldwide prominence. By the year 2000, the IAEA projects that more than half of the countries with nuclear power reactors will be developing countries. With the expected growth in countries with little nuclear operating experience and limited resources, nuclear safety will likely continue to be a concern.

RESULTS IN BRIEF

There have been significant and potentially significant incidents involving the safety of nuclear power reactors in other countries. Many countries, under some future circumstances, may not be able to respond adequately to an accident at their nuclear facilities.

The United States has been participating in multilateral and bilateral efforts to strengthen international nuclear safety. The Soviet Union has agreed to participate in the IAEA incident reporting system. However, the United States has reservations about joining.

The international community has been reluctant to agree in advance on a legal framework for providing assistance to one another in the event of a serious nuclear accident, contenting themselves with the development of non-binding guidelines.

GAO ANALYSIS

Extent and Seriousness of Foreign Safety

Information on the extent and seriousness of safety related incidents in foreign countries is not readily available. The U.S. Nuclear Regulatory Commission collects information, including foreign proprietary data, on such incidents at foreign power reactors and, to the extent practical, assesses their significance to U.S. designed reactors. Its assessments, however, are judgmental and based on reports that are not always clear and complete.

In response to a 1982 questionnaire from IAEA, 44 of 56 countries indicated that they may not be adequately prepared to deal unilaterally with a major radiation accident and might require outside assistance.

International Efforts to Deal with Nuclear Safety Issues

Through the IAEA and/or the Nuclear Energy Agency, an organization composed of 24 industrialized countries, efforts have been initiated to develop safety standards or guidelines, exchange information, conduct research, and provide training and expert assistance to help improve nuclear safety. The Nuclear Regulatory Commission also has negotiated bilateral nuclear safety arrangements with 21 countries.

Sharing Safety Information

Through its participation in the Nuclear Energy Agency incident reporting system and bilateral safety arrangements, the United States and other participating countries share information on operating experience on about 80 percent of the world's power reactors. Since 1983, IAEA has been working to establish an incident reporting system which would include Eastern bloc and developing countries as well as Nuclear Energy Agency countries. The Soviet Union and several other Eastern bloc countries recently agreed to participate. Before the United States agrees to join, U.S. officials want assurance that these countries will fully share information. They believe it would not be equitable for the United States to provide results of costly analytical work to the Soviet Union without getting something in return. Also, U.S. officials want to avoid potential duplication between the IAEA and the Nuclear Energy Agency systems.

Framework for an International Response to a Nuclear Accident

A serious nuclear accident may require the assistance of other countries. However, such problems as the threat of legal action and liability for expenses incurred in providing assistance could impede external assistance efforts. U.S. officials believe an agreement should be reached to resolve such problems in advance, but most countries have been unwilling to commit themselves to development of such an agreement. IAEA has developed guidelines, but these are not binding. Some regional agreements have been reached, but the resources required to respond to a major nuclear accident are not available in all regions.

RECOMMENDATIONS	GAO is making no recommendations.
AGENCY COMMENTS	The Department of State and the Nuclear Regulatory Commission agreed with the principal findings in the report. State said that if U.S. agencies insist that any U.S. assistance provided to a foreign nation in response to a nuclear accident be conditioned on the acceptance by the recipient of the terms and conditions of the IAEA guidelines, U.S. interests would be fully protected.

Contents

TABLES AND ILLUSTRATIONS

ABBREVIATIONS

GAO	General Accounting Office
IAEA	International Atomic Energy Agency
NEA	Nuclear Energy Agency
NRC	Nuclear Regulatory Commission
OECD	Organization for Economic Cooperation and Development
PWR	Pressurized Water Reactor

CHAPTER 1

INTRODUCTION

The increasing international use of nuclear energy and radioactive materials over the past 25 years has brought about an awareness of the need to ensure the health and safety of the general public as well as those directly working with the technology. According to the International Atomic Energy Agency (IAEA),[1] the overall nuclear safety record over the years generally has been good, but the accident at Three Mile Island propelled the question of nuclear safety into worldwide prominence. Although safety issues arise in all facets of the nuclear fuel cycle, the emphasis in this report is the safety of power reactors.

Controversies over the results of various nuclear safety studies have added to public concern. Questions about the probability of a nuclear accident and its consequences continue. In the United States, although the general public still looks upon nuclear power as a long-term energy source, public support for the nuclear industry has been declining. According to a February 1984 Office of Technology Assessment report, entitled Nuclear Power in an Age of Uncertainty, the public attitude toward nuclear power has become increasingly negative. The report states that the attitude is due to a variety of factors, including the ongoing debate among experts over reactor safety and individual perceptions of the likelihood of a catastrophic reactor accident.

According to the Office of Technology Assessment, the handling of safety issues by the nuclear industry and the government has led many people to the conclusion that both have seriously underestimated safety problems.

The Commission of the European Communities issued a report, Public Opinion in the European Community: Energy in October 1983 for which 9,700 citizens were surveyed in the 10 member countries of the European Community. The results showed that 51 percent of those surveyed were concerned about radioactive emissions and 38 percent believed that a bomb-like explosion at a nuclear power plant was somewhat or very possible.

---

[1]The IAEA, an autonomous agency of the United Nations, was founded in 1957 to accelerate and enlarge the contributions of atomic energy to world peace, health, and prosperity and to detect the diversion of nuclear material for unauthorized purposes. It is headquartered in Vienna and has 112 member states. IAEA has programs aimed at strengthening the operational safety of nuclear power plants. (See ch. 3.)

POTENTIAL CONSEQUENCES OF A NUCLEAR ACCIDENT

The potential consequences of a nuclear power reactor accident is a central issue in the debates on the future of nuclear energy. Experts agree that the greatest danger from a nuclear accident is the release of significant amounts of radioactive materials into the environment rather than a nuclear (bomb-like) explosion.[2] The main safety concern arising from nuclear power plant operation is that should the safety mechanisms fail the fuel assemblies could overheat and melt, releasing radioactivity into the environment. In the event of such an accident, people near the accident could receive harmful levels of radiation either externally or by inhaling the radioactive materials. This type of exposure would usually occur shortly following the release. The radioactive fallout could also contaminate food and water supplies. Weather conditions, wind direction, and geography would determine the path and extent of the offsite hazard.

According to the U.N. Environment Program, exposure to sufficient levels of radioactive material will alter and destroy cells; deplete cells in the bone marrow; damage gonadal cells, leading to impaired fertility; increase the probability of developing cancer; and cause immediate illness or death. The probability and severity of these effects will vary according to the amount of exposure and can affect both the individuals exposed and their offspring.

GROWTH OF NUCLEAR POWER AND SAFETY CONCERNS

Although the pace of nuclear power plant construction internationally has slowed, more countries will begin nuclear power plant operations in the 1980's as plants ordered or planned in the 1970's are completed. As of June 30, 1984, 306 nuclear power plants were in operation in 25 countries; according to IAEA estimates, an additional 224 were under construction or on order. When these additional plants are completed, 33 countries will have nuclear power reactors. (See table 1.)

In 1984, 10 of the 25 countries with nuclear power plants in operation were developing countries; Mexico, Cuba, Romania, Poland, and the Philippines are currently constructing nuclear plants for the first time. By the year 2000, the IAEA projects that slightly more than half of the countries with nuclear power plants will be developing countries.

---

[2]Further Actions Needed to Improve Emergency Preparedness Around Nuclear Powerplants, Aug. 1, 1984 (GAO/RCED-84-43).

Table 1

Operative Commercial Nuclear Power Plants And Projected Growth Worldwide as of June 30, 1984

Location	Plants in operation	Additional plants under construction or on order	Total
Developed countries:			
Belgium	5	2	7
Canada	12	10	22
Finland	4	-	4
France	36	27	63
Germany, Democratic Republic of	5	2	7
Germany , Federal Republic of	12	16	28
Italy	3	3	6
Japan	27	15	42
Netherlands	2	-	2
South Africa	-	2	2
Soviet Union	37	22	59
Spain	5	13	18
Sweden	10	2	12
Switzerland	4	3	7
United Kingdom	35	7	42
United States	83	53	136
Subtotal	280	177	457
Developing countries:			
Argentina	2	1	3
Bulgaria	4	-	4
Brazil	1	2	3
China, People's Republic of	-	3	3
Cuba	-	2	2
Czechoslovakia	3	7	10
Egypt	-	2	2
Hungary	1	3	4
India	5	5	10
Korea, Republic of	3	6	9
Mexico	-	2	2
Pakistan	1	-	1
Philippines	-	1	1
Poland	-	6	6
Romania	-	6	6
Taiwan	5	1	6
Yugoslavia	1	-	1
Subtotal	26	47	73
Total	306	224	530

Source: International Atomic Energy Agency and Nuclear News Magazine, Aug. 1984.

With the expected growth, especially in countries with little or no prior experience in operating nuclear power plants and with inadequate technical resources for supporting effective, independent nuclear safety programs, nuclear safety will likely continue to be a concern. Developing countries in particular face difficulties in establishing indigenous nuclear safety programs. According to IAEA officials, most developing countries lack trained personnel to draft nuclear safety standards or to train nuclear safety personnel.

According to IAEA and U.S. government officials, the responsibility for nuclear safety rests within the individual countries that operate nuclear power plants. However, to help these countries with their responsibilities, IAEA, the Nuclear Energy Agency (NEA)[3], the U.S. Nuclear Regulatory Commission (NRC)[4] and others have undertaken programs to strengthen the safety functions of regulatory authorities and are conducting research to resolve safety issues involving nuclear power operations.

OBJECTIVES, SCOPE, AND METHODOLOGY

Our objectives were to

--assess available information as to safety problems at nuclear power reactors abroad and countries' ability to handle them (see ch. 2);

--determine the status of international efforts to cope with nuclear safety issues (see ch. 3);

--review the extent to which information on nuclear accidents is being accumulated and shared internationally (see ch. 4); and

--review efforts to establish a framework for an international response to a nuclear accident (see ch. 5).

---

[3]NEA, consisting of 24 member nations, is a specialized agency of the Organization for Economic Cooperation and Development and was established to promote cooperation on nuclear safety and regulatory matters and to assess the economic contribution of nuclear power.

[4]NRC conducts a wide range of nuclear safety activities and cooperates with other countries and international organizations, such as IAEA and NEA, on civil radiological health and safety issues.

Our work was conducted in accordance with generally accepted government auditing standards. Information for this report was obtained from documents and/or interviews with officials at the Departments of Energy and State, the NRC, and the IAEA in Vienna and NEA in Paris and the U.S. missions to them. We also attended an Atomic Industrial Forum conference and reviewed publications by the U.N. Environment Program and the nuclear trade associations.

Because of the non-uniformity in the types of operating incidents reported by the United States and foreign countries, we did not make comparisons of the safety significance of incidents reported in those countries.

The comments of the Department of State and NRC are included as appendixes II and III, respectively. We also considered additional comments made by the Director of NRC's Office of International Programs and his staff. These comments were assessed and incorporated as appropriate throughout the body of this report.

CHAPTER 2

EXTENT OF NUCLEAR SAFETY PROBLEMS AND COUNTRIES' ABILITY TO HANDLE REACTOR ACCIDENTS

Except for a few widely publicized accidents in the United States, such as the one at Three Mile Island, the extent and seriousness of significant safety-related reactor incidents at nuclear power plants throughout the world are not generally known. Since the Three Mile Island accident, U.S. officials have learned of a number of safety-related problems with nuclear power reactors at foreign facilities, similar to those in the United States. Our review showed that (1) there have been significant or potentially significant incidents involving power reactors overseas, (2) a number of safety issues remain unresolved, and (3) many countries may not be able to respond adequately to an accident at their nuclear facilities.

SAFETY FEATURES IN REACTORS

Nuclear power plants are designed to contain radioactive materials within the confines of the reactor and to provide the necessary coolant to keep the fuel from melting. Nuclear power reactors have three barriers that would have to be successively breached before radioactive materials could escape into the environment. (Figure 1 shows an example of the barriers associated with a pressurized light water reactor. A boiling light water reactor has similar barriers but the schematics are different.)

1. Fuel rods, which seal the fuel in a metal sheath to prevent radioactive products from entering the coolant system.

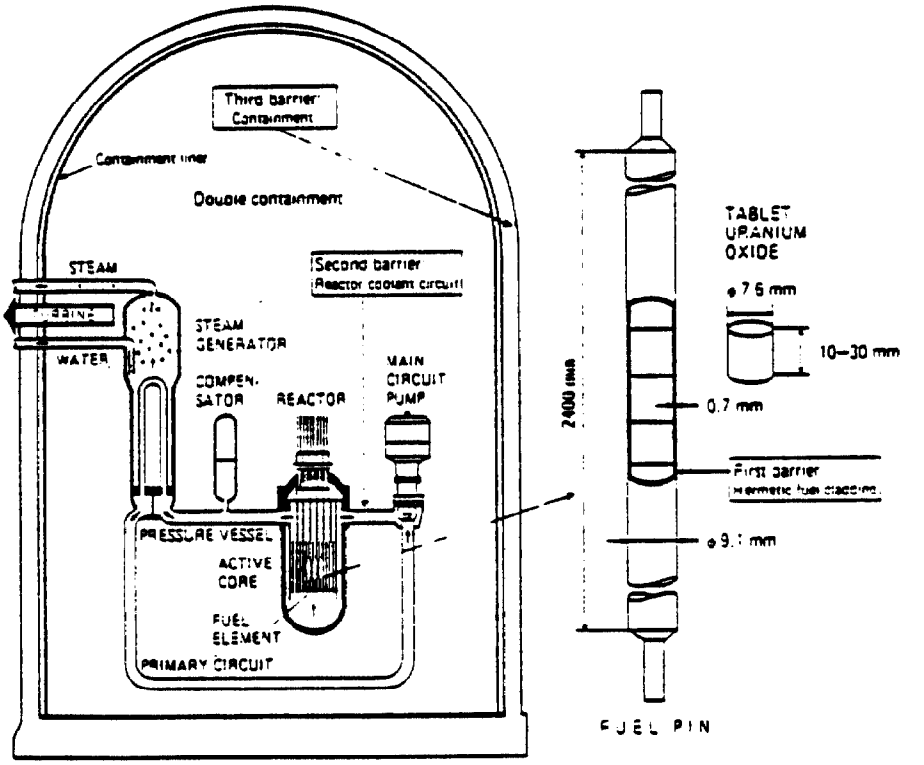
2. Reactor coolant circuit, which is sealed from the outside environment.

3. The containment building, a large structure of steel and concrete containing the nuclear reactor's core and designed to withstand high pressures.

According to NRC officials, locating power plants in relatively low-population zones and planning adequately for emergency evacuation of nearby population in the event of an accident could represent a fourth barrier.

Figure 1

The Three Safety Barriers in Pressurized Light Water Nuclear Power Reactors



Source: International Atomic Energy Agency.

NATURE OF A REACTOR ACCIDENT

A reactor accident sufficiently severe to have public health consequences must rupture all three safety barriers, especially the containment building, and disperse a significant amount of radioactive material. This can happen only if the reactor core melts and there is a failure in the containment structure.

Overheating and melting of reactor fuel elements arise from two types of accidents--loss of coolant and transient events. A loss of coolant accident occurs if there is a rupture in the reactor coolant system boundary and the fuel elements overheat before emergency coolant can be provided. According to NRC, a transient event occurs when the heat removal capacity of the reactor malfunctions due to equipment failure or human error.

To prevent or mitigate the consequences of an accident, a light water[1] power reactor is designed with automatic safety features to shut it down, remove certain radioactive materials and reduce the temperature of its core. According to NRC, these automatic systems include the following.

--Reactor shutdown to stop the chain reaction by automatically inserting neutron-absorbing control rods.

--Emergency core cooling, provided by redundant and sometime diverse systems, to prevent the fuel from overheating and rupturing the sheathing in the event of a loss of coolant accident.

--Post-accident radioactivity removal to remove radioactive by-products which are soluble in water through the use of a spray system within the containment building in the event the reactor coolant system boundary is breached.

--Air cleaning systems that use filters, such as charcoal, to remove particulates.

--Post-accident heat removal to reduce temperature within the core through the use of exchangers so that radioactive substances are safely contained.

If these automatic systems fail, NRC points out that a core meltdown would occur and the containment building could fail if (1) the pressure rises to the failure point of the building from the build-up of non-condensible gases, steam explosion, and the burning of flammable gases, such as hydrogen, and (2) the molten core penetrates the floor of the building, permitting radioactive material to escape through the ground.

---

[1]The light water reactor is fueled by slightly enriched uranium and uses ordinary (light) water as both its moderator and coolant. The light water reactor was first type commercialized in the United States and is the most common type of nuclear powerplant. In contrast, the Canadian-type heavy water reactor is fueled by natural uranium and moderated by heavy water.

If the containment building fails, the specific sequence of events that leads to the failure will determine the amount and composition of the radioactive material that escapes. Once containment has been breached, radioactivity would be released and dispersed in the direction of the wind.

NUMBER OF SAFETY INCIDENTS ABROAD

The NRC collects information on safety-related operating incidents at foreign nuclear power plants from a number of sources but told us that it relies primarily on the NEA and IAEA incident reporting systems and on information shared under bilateral nuclear safety agreements. Because the types of safety incidents reported are not uniform and the reports are not always complete or publicly available, worldwide statistics on the frequency and nature of safety-related incidents are not generally available or easily determined. The safety significance of the reported events also varies considerably due to the variety of types of plants and plant designs worldwide. For example, even in reactors of a similar type, the degree of redundancy and diversity in safety systems varies from plant to plant and from country to country. However, based on reported foreign operating experiences, NRC believes that types of events occurring in foreign countries are similar to those in the United States.

After screening for safety implications, NRC determined that 151 incidents affected the safe operation of the nuclear power plants involved; 2 were characterized as "significant" and 149 as "potentially significant" to safe operations. According to NRC, a significant incident would include (1) significant release of or exposure to radioactive material, (2) significant degradation of safety-related systems, (3) significant deficiencies in design, construction, operation or safety evaluation, (4) significant generic problems, and (5) significant consequential actions. A potentially significant incident refers to events which appear to have such safety implications and thus are candidates for further evaluation.

UNRESOLVED SAFETY ISSUES

IAEA, NEA, NRC, and the responsible authorities in different countries have been examining nuclear safety incidents to identify where further improvements in system designs or operational practices and safety research are considered necessary. For example, NRC is required by the Energy Reorganization Act of 1974, as amended, to follow incidents at domestic nuclear power plants and to identify those safety issues requiring further study. NRC had identified 27 unresolved safety issues in its Unresolved Safety Issues Summary, but as of May 1984, NRC officials reported that a technical resolution had been achieved for 15 of these. NRC continues to work toward technical resolution for the following 12 unresolved safety issues which affect a number of nuclear power plants and are important to public health and safety.

Unresolved Safety Issues Identified by NRC

1-3. Pressurized water reactor steam generator tube integrity (problems with three different reactor designs.)

4. Systems Interactions (events that may jeopardize the independent functioning of power plant safety systems).

5. Seismic design criteria.

6. Containment emergency sump performance (after a loss-of-coolant accident, long-term recirculation must be maintained by operation of residual heat removal pumps to prevent core melt).

7. Station blackout (concurrent loss of both on- and off-site power).

8. Adequacy of system for removing decay heat from a reactor core during shutdown.

9. Seismic qualification of equipment in operating plants.

10. Safety implication of control systems.

11. Hydrogen control measures and effects of hydrogen burns.

12. Pressurized thermal shock (neutron irradiation of reactor pressure vessel weld and plate materials decreases fractural toughness; this could cause a crack that might grow to threaten vessel integrity).

In our September 1984 report[2] on NRC efforts to address safety issues, we pointed out that there are at least 29 other high-priority safety issues, 11 of which based on NRC criteria, may be as important to safety as the unresolved safety issues reported by NRC. IAEA and NEA experts, including some from the United States, have met to discuss a number of these and other safety problems and have exchanged papers on certain safety issues.

Although studies of accidents in the United States have more often faulted plant operations rather than equipment failure, the Office of Technology Assessment has reported hardware malfunctions in virtually every system, including control rods, steam generators, coolant pumps, and fuel rods. It reported that the majority of these hardware problems have been resolved but that problems still persist and others continue to surface. It also concluded that the discovery of new problems and slow resolution of old ones continues to erode confidence in the safety of light water reactors. NRC officials informed us that the occurrence of equipment problems is fully expected and humanly unavoidable in large power plants made up of thousands of individual components; this is the reason for surveillance testing. The purpose of sharing operating experience is so each individual plant can benefit from the information obtained from hundreds of other plants.

INDIVIDUAL COUNTRIES LACK UNILATERAL RESPONSE CAPABILITY

According to IAEA, a nuclear accident having a significant radiation release would require a substantial response. Such an accident in a developing country could tax resources and could be beyond the country's capabilities. Even highly developed countries with many nuclear power facilities and a large technical supporting infrastructure could have difficulty in coping effectively with nuclear accidents, especially those involving significant off-site radiation release. A nuclear accident in border areas could have serious effects on neighboring coun-

---

[2]Management Weaknesses Affect Nuclear Regulatory Commission Efforts to Address Safety Issues Common to Nuclear Power Plants, Sept. 19, 1984 (GAO/RCED-84-149).

tries, especially those which have no nuclear plants and, therefore, very limited capability to respond to the situation.

A July 1982 IAEA report addressed the kinds of assistance that could be required in a major radiation accident and indicated that many IAEA member nations might not be prepared to unilaterally deal effectively with such an accident. The report, which was based on a questionnaire, showed that 44 of 56 countries indicated that they might require some assistance from other countries in the event a serious nuclear accident occurred within their borders; 12 others believed that domestic resources would be adequate to respond but some of the 12 indicated that they too would require outside help in certain contingencies involving large nuclear accidents.

IAEA technical guidance publications have identified three time period phases associated with an accident at a nuclear facility and the type of assistance that might be needed at each phase.

1. The early phase: this period begins with the onset of an accident and lasts from several hours to one or two days.

2. The intermediate phase: the period of recovery from the accident, extending from days to weeks after the early phase.

3. The late phase: the period after recovery, extending from months to years.

IAEA experts have reported that, although all countries with nuclear facilities should have the capability to respond to emergencies in accordance with the size of the nuclear program, such capability may be beyond the resources of certain countries. According to IAEA, at a minimum, countries should be able to mount a self-sufficient response during the early phase of an accident as it would take 2 to 3 days to obtain substantial resources from other countries. Specific needs which individual countries must unilaterally meet during the early phase include technical advice, radiological monitoring equipment, and medical care.

During the intermediate phase, the assistance needed would depend on the continuing course of the accident and the success in mitigating its consequences during the early phase. According to IAEA, the amount of assistance needed during the intermediate phase may be substantially higher than that needed during the early phase, depending on the extent of on and off-site consequences of the accident. Depending on the internal resources available in the affected country, these augmented needs may have to be obtained from external sources.

If substantial resources are required during the intermediate phase of an accident, they are also likely to be required during the late phase as recovery from the accident proceeds. According to IAEA, needs in this late phase are likely to be highly specialized and oriented toward clean-up, equipment maintenance or replacement, and waste management.

CHAPTER 3

INTERNATIONAL EFFORTS TO DEAL WITH NUCLEAR SAFETY ISSUES

The United States has been participating in the multilateral programs of the IAEA and NEA and in bilateral efforts to strengthen international nuclear safety.[1] According to NRC, international initiatives to help improve nuclear safety include

--developing internationally recognized nuclear safety standards;

--exchanging information on regulatory criteria and procedures and assisting the safety efforts of countries just starting nuclear programs;

--sharing the results of reactor safety research and operational safety data;

--conducting research in areas of major nuclear safety concern; and

--improving international nuclear emergency planning and preparedness.

IAEA's SAFETY PROGRAM

IAEA's Nuclear Safety Program employs 30 professionals and has an annual budget allocation of more than $5 million. The objective of the program is to assist member states in ensuring the safe use of nuclear energy and to protect the environment and the public from the harmful effects of nuclear radiation and radioactive releases from nuclear facilities. To achieve this objective, IAEA has developed a series of internationally recognized nuclear safety standards, provides its members with advisory missions, conferences, seminars, and training courses on safety, and exchanges safety-related information among members.

---

[1]The U.S. government, private organizations such as the Institute of Nuclear Power Operations, and individuals also participate in other international organizations having programs for the advancement of nuclear safety issues, including the (1) International Commission on Radiological Protection, (2) International Labor Organization, (3) U.N. Environmental Programme and U.N. Disaster Relief Organization, (4) International Organization for Standardization, and (5) World Health Organization.

IAEA's Basic Safety Standards for Radiation Protection provides guidelines for occupational exposure of workers and members of the public and for national regulations and practices. IAEA also assists its 112 member states in applying these standards.

The IAEA's nuclear safety standards program for power reactors, initiated in 1974, has developed safety codes and guidelines for government regulatory organizations and for power plant siting, design, operation, and quality assurance. According to the IAEA, the nuclear safety standards represent recommendations for use by member states in the context of their own nuclear safety requirements and are designed to allow incorporation into many countries' regulatory systems. According to IAEA documents, member states are expected to follow these safety standards for projects that receive IAEA assistance. However, IAEA recognizes that the final decisions and legal responsibilities in any national regulatory system rest with the domestic authorities. IAEA has published 43 of the planned 61 safety codes and guidelines which comprise the nuclear power reactor safety standards program; the remaining 18 are scheduled to be completed in 1985.

IAEA also provides advisory services to enhance safety and improve regulatory practices of member states on request. Advisory services consist of safety missions (which provide short-term consultations on safety issues) and operational safety review teams (which provide technical support for the inspection and enforcement activities of regulatory authorities in member states).

Safety missions are composed of IAEA experts who provide consultation and technical assistance on plant licensing, siting, design, construction, and operation. Teams are sent to requesting countries for periods lasting from a few days to one month; individual experts can be assigned to a country for up to a year. According to IAEA officials, member states frequently request advice on

--organization of a regulatory body within the government structure;

--site survey and evaluation and review of site design issues;

--safety reviews required for licensing purposes;

--evaluation techniques to be used in analyzing plant safety;

--general conclusions from assessments of reported incidents so as to avoid recurrence;

--measures required to arrange for appropriate emergency planning and preparedness.

Since 1982, IAEA Operational Safety Review Teams, on request, have audited operational safety practices to help the requesting country's regulatory agency ensure that required safety measures are maintained during all phases of nuclear power plant operations. Each team, consisting of 8 to 10 experts recruited from the IAEA staff and outside consultants, spends about 3 weeks at a nuclear reactor site examining plant records and documents, discussing technical and administrative details with plant officials, and observing plant personnel. At the end of the visit, the team prepares a report containing conclusions and recommendations which is issued to the country. The country is not required to implement the recommendations. A few safety team reviews are conducted each year.

Since December 1981, IAEA has held several meetings in Moscow, Prague, and Vienna to explore areas for future cooperation in safety research. The meetings covered fuel behavior under accident conditions, loss of coolant accidents, radioactive releases, man-machine interactions, primary circuit integrity, and early diagnosis of failures. According to IAEA, the meetings are valuable because they discuss current research in particular fields and seek to develop recommendations on what future actions need to be taken. In 1982, IAEA began developing an incident-reporting system which would allow all countries with nuclear plants to share data on unusual events affecting the safety of a plant. In 1983, the IAEA started to operate its system on a trial basis.

IAEA has conducted nuclear power training directed toward the planning, construction, and operational needs of developing countries. Within the past 4 years, almost 350 participants from over 20 developing countries have attended 11 specialized safety-related courses. IAEA recently compiled and published an international inventory of nuclear power training facilities, listing safety courses at academic, government, and private institutions.

NEA SAFETY SERVICES

The NEA, headquartered in Paris, has a permanent staff of 84 and an annual operating budget of approximately $4 million. It operates an incident-reporting system, funds safety research projects, and conducts international exercises through which it compares the techniques used by various members to assess the performance of nuclear plant safety systems. In addition, NEA sponsors meetings and conferences to exchange safety data. The United States contributes about $1 million, or 25 percent, of NEA's annual operating budget as well as funds for NEA research

NEA, whose member nations[2] account for 238 (or 77 percent) of the 306 nuclear power plants currently in operation worldwide, devotes two-thirds of its resources to nuclear safety, waste management, and regulation. Its safety program is directed by the Committee on the Safety of Nuclear Installations, composed of scientists and engineers from NEA member states. The Committee has established five working groups which coordinate research and development activities in the areas of

--operating experience and human factors;

--reactor transient and primary circuit breaks;

--integrity of pressure vessels and pipes;

--source term[3] and environmental consequences; and

--risk assessment.

Under the auspices of NEA, several research projects are being conducted to study the effects of loss of coolant accidents. Several other NEA members have joined the United States to sponsor research at the Loss of Fluid Test facility in Idaho. This research is designed to validate computer programs used to predict the effects of loss of coolant accidents in power plant facilities and to study more effective ways to mitigate accident consequences. The United States is providing about 80 percent of the funding for this research, and other countries are expected to provide the remaining 20 percent of the estimated $92 million for experiments to be conducted through 1986.

NEA is also sponsoring research on (1) the extent to which radioactive materials would be released during an accident and how to mitigate their effects, (2) fuel behavior and man-machine interactions during abnormal incidents, (3) ways to perfect air cleaning systems which would service the auxiliary and secondary containment buildings during an accident, and (4) probabilistic risk assessment techniques to evaluate the amount of radiation received by the public after an accident.

---

[2]Australia, Austria, Belgium, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

[3]Source term refers to the composition, activity, and rate of release of radioactive materials to the environment during an accident.

NEA has conducted numerous international exercises in connection with loss of coolant accidents and other safety-related issues. Since 1975, it has been comparing different computer programs used by member countries to predict thermohydraulic behavior during a loss of coolant accident and emergency core cooling system operations under emergency conditions.

NEA established an incident reporting system in 1980 to enable regulatory authorities and power companies to identify areas where the design or operations of nuclear power plants can be improved and to prevent recurrence of safety-related incidents. IAEA and NEA held meetings in 1983 to extend coverage of the system to non-NEA members. (See ch. 4 for discussion of NEA and IAEA incident reporting systems.)

BILATERAL EFFORTS TO ENHANCE NUCLEAR SAFETY

As a major supplier of nuclear power equipment and technology, the United States is also involved in ongoing efforts to enhance international nuclear safety through bilateral assistance. The NRC offers training and provides experts to and exchanges information with other countries. Although the ultimate responsibility for nuclear safety rests with the authorities that operate nuclear reactors, NRC officials point out that their foreign safety program ensures that every country using U.S. technology has access to U.S. nuclear safety expertise.

The U.S. mechanism for international cooperation in the peaceful uses of nuclear energy is a bilateral agreement for cooperation which provides for an exchange of information on operating performances. Within this framework, since 1974 NRC has negotiated separate bilateral arrangements for nuclear safety information exchanges and cooperation. These arrangements are negotiated with the regulatory agencies of other countries and, according to the NRC, establish official communication channels on reactor safety problems, set up a network for cooperation, and provide a vehicle for U.S. assistance in health and safety matters.

As of June 1984, 21 bilateral safety arrangements had been established with the following countries.

Belgium
Brazil
The People's Republic of China
Denmark
Egypt
Finland
France
The Federal Republic of Germany
Greece
Israel
Italy
Japan
Republic of Korea
Mexico
The Netherlands
The Philippines
Spain
Sweden
Switzerland
Taiwan
United Kingdom

The arrangements call for the exchange of information, through technical reports, correspondence, newsletters, and meetings, concerning

--regulatory procedures;

--significant licensing actions and safety and environmental decisions;

--NRC regulations on U.S. facilities deemed to be similar to those operated by the involved country;

--technical, safety, and environmental effects; and

--operating experience, including abnormal incidents, accidents, and plant reliability.

These arrangements often provide for training foreign regulatory officials in the United States, with costs borne by the requesting country, and sometimes provide for cooperation in reactor safety research and the exchange of personnel. Typically, the arrangements are in effect for 5 years and can be renegotiated or extended by written agreement.

The renegotiated bilateral safety arrangement for the Republic of Korea included new provisions whereby the NRC agreed at the request of the Korean Ministry of Science and Technology to render assistance in case of an accident. Assistance could include establishing a communication channel with NRC to monitor the severity of the accident and providing technical advice, a team of safety experts, and off-site protective measures.

ROLES OF U.S. GOVERNMENT AGENCIES

A number of U.S. agencies are involved in U.S. efforts to improve international nuclear safety. Their principal nuclear safety-related activities are outlined below.

The State Department's Bureau of International Organization Affairs, in coordination with the U.S. Representative to the IAEA, directs overall U.S. participation in the IAEA, with technical assistance from other federal agencies, such as NRC and the Department of Energy. The technical assistance includes training courses and equipment as well as cost-free experts who also participate in IAEA technical advisory group meetings.

The State Department's Director of Energy Technology Cooperation, in coordination with the U.S. member of the NEA Steering Committee, directs U.S. participation in the NEA.

The NRC provides the IAEA with experts for safety missions, review teams, and cost-free experts. Its Executive Director for Operations chairs NEA's Committee on the Safety of Nuclear Installations, and NRC staff members sit on each of the five principal working groups of the Committee. The Department of Energy provides IAEA with training courses through the Argonne National Laboratory. It also provides representatives to NEA. The Department of Transportation, Environmental Protection Agency, and National Bureau of Standards provide technical assistance for some ongoing IAEA projects.

CHAPTER 4

INTERNATIONAL SHARING OF NUCLEAR SAFETY INFORMATION

Since the Three Mile Island accident, countries operating nuclear power plants have become increasingly aware of the need to share operational safety data and experience to help prevent accidents. If reactor operators are aware of incidents that have occurred elsewhere, abnormal events may be avoided or their severity mitigated. The United States participates in bilateral and NEA incident reporting efforts, but it has been reluctant to participate directly in the IAEA system until problems of apparent duplication with the NEA system and the lack of meaningful participation by non-NEA countries are resolved.

LEARNING FROM OPERATING EXPERIENCE OF POWER REACTORS

As of June 1984, operators in about 300 nuclear power plants worldwide had accumulated over 3,100 years of reactor experience. Many of the plants have been in operation for 15 years and some for as long as 25 years. According to IAEA, this experience is valuable for recognizing the causes of accidents and the methods of avoiding or dealing with them. The extent to which nuclear accidents might be avoided or their effects mitigated through the international sharing of reactor experience probably cannot be quantitatively measured. However, after the Three Mile Island accident, U.S. officials learned that similar incidents had occurred at nuclear power plants in Switzerland (in 1974) and Ohio (in 1977)[1], but the operational experience gained from them was not readily available for use at Three Mile Island.

The President's Commission on the Accident at Three Mile Island recommended that, as part of a normal safety assurance program, every new report of an accident or new abnormal event be carefully screened and, where appropriate, rigorously investigated to assess its implications for nuclear safety. NRC established the Office for the Analysis and Evaluation of Operational Data to identify and feed back significant safety lessons of operational experience to licensees, the nuclear industry, and the public. The utility industry created the Institute of Nuclear Power Operations. In January 1980, the United States and other NEA members established an incident reporting system among themselves. IAEA has been trying since 1982 to establish a worldwide incident reporting system, but the United States and

[1]In both cases the problems were solved before serious damage was done. Information on the Ohio experience was provided to the NRC but was not known to the operators of Three Mile Island.

some other industrialized countries have been reluctant to commit themselves to full and direct participation in it because it potentially duplicates the NEA system and may not include meaningful reporting by Soviet bloc nations.

EXTENT OF COVERAGE UNDER INCIDENT REPORTING ARRANGEMENTS

NEA's incident reporting system includes all 13 NEA countries operating nuclear power reactors and covers 77 percent of the power reactors operating worldwide. Through March 1984 over 450 incidents have been reported since the system began in 1980. Over 200 incidents were reported by other members, the remainder were reported by the United States. These reports are reviewed by experts from participating countries to identify major safety problems and are used by the Committee on Safety of Nuclear Installations which directs NEA's research program.

IAEA drafted guidelines (with significant U.S. encouragement and assistance) to help countries establish their own incident reporting systems for identifying and evaluating unusual safety incidents. IAEA has been working to establish an incident reporting system which would include Eastern bloc and developing countries as well as NEA countries; 8 NEA countries and 10 other countries have agreed to participate in the system, as shown in table 2.

Foreign operating experiences cited by IAEA, covering both NEA and non-NEA members, included a temporary loss of the ultimate heat sink at a pressurized water reactor (PWR) plant; steam binding incidents in emergency feedwater pumps at a PWR which may render them inoperable; failure of a reactor coolant pump which deposited abrasion products in the reactor pressure vessel and the reactor core, leading to reduced flow and increased fuel temperatures; reactor coolant pump seal failures with primary coolant leakage; and a serious fire in electrical cables which affected some control and instrumentation systems.

Other types of events or concerns reported at non-U.S. plants involved deficiencies in quality assurance programs, replacement of steam generators at PWRs, problems with the reliability of diesel generators in emergency power systems, station blackout events, and anomalies in systems designed to control the fission process, to provide core cooling and to safely shut down the plant. Still others involved failures or malfunctions of (1) relief and safety valves during surveillance testing and operations, (2) residual heat removal capability, and (3) condensate and feedwater makeup.

With U.S. assistance, NEA and IAEA have developed essentially the same reporting criteria for identifying severe incidents and accidents. Participants in each system screen incidents and prepare reports on incidents which threaten power

Table 2

PARTICIPATION IN THE IAEA INCIDENT REPORTING SYSTEM AS OF MAY 1985

Member states	Status of participation	Participation in IAEA or IAEA/NEA meetings
Argentina	Participant	Yes
Belgium	Through OECD/NEA	Yes
Brazil	Participant	Yes
Bulgaria	Participant	Yes
Canada	No response to IAEA invitation to join	Yes Yes
Czechoslovakia	Participant	Yes
Finland	Participant	Yes
France	Through OECD/NEA[a]	Yes
Federal Republic of Germany	Through OECD/NEA[a]	Yes
German Democratic Republic	Participant	Yes
Hungary	Participant	Yes
India	Participant	Yes
Italy	Through OECD/NEA	Yes
Japan	No response to IAEA invitation to join	Yes
Republic of Korea	Participant	Yes
Netherlands	Participant	Yes
Pakistan	Participant	Yes
Sweden	Through OECD/NEA	Yes
Soviet Union	Participant	Yes
Spain	Through OECD/NEA	Yes
Switzerland	No response to IAEA invitation to join	Yes
United Kingdom	No response to IAEA invitation to join	Yes
United States	No response to IAEA invitation but expected to join	Yes
Yugoslavia	No response to IAEA invitation to join	Yes

[a]Trial period.

Source: Division of Nuclear Safety, IAEA

plant safety and send them to either the IAEA or NEA, which process the reports and distribute them to participating members.

In the United States, both government and industry collect data on operational experiences of U.S.-designed plants overseas. The NRC, through its bilateral arrangements with other countries, generally receives some information on safety events through technical reports, correspondence, newsletters, meetings, and training courses. The Institute of Nuclear Power Operations, a U.S. industry organization, has expanded its domestic reporting system to include foreign reactors.

Nevertheless, our analysis of the current coverage of reports of safety incidents as of May 1984 shows the following coverage.

—The NEA system covers 13 of the 25 countries with nuclear power reactors; NEA membership is limited to Organization for Economic Cooperation and Development member countries, which does not include developing and Eastern bloc countries. According to NRC, whether Eastern bloc countries are willing to share information on operating experience remains to be seen.

--18 of the 25 nations that operate power reactors have agreed to participate fully in IAEA's incident reporting system and 8 of these 18 already participate in the NEA system.

--The NRC has bilateral arrangements for sharing information about U.S.-designed reactors with 21 countries, 11 of which are also covered under NEA arrangements and 7 of which do not presently operate nuclear power reactors.

--The United States does not routinely receive reports from or provide them to Argentina, India, Pakistan, and Eastern bloc countries. In addition, the United States will not obtain incident reporting data from the Soviet-designed reactors now being built in Cuba.

Through participation in the NEA incident reporting system and bilateral safety arrangements, the United States shares information on nuclear operating experiences covering about 80 percent of the world's power reactors; most of the remaining 20 percent are in Eastern bloc countries.

U.S. RELUCTANCE TO JOIN IAEA SYSTEM

The United States and some other countries of the Organization for Economic Cooperation and Development have been reluctant to join IAEA's incident reporting system because they

believe it duplicates NEA and NRC efforts and could provide the Soviet Union with information on U.S. reactors without receiving similar information on Soviet reactors. NRC officials stated that the United States already receives incident reports from developed countries through the NEA and can obtain information about incidents from developing countries through its bilateral arrangements.

NRC and State Department officials indicated that as conditions for U.S. participation they want (1) commitments that Soviet Bloc countries (especially the Soviet Union) as members of IAEA will contribute meaningful information to the system and (2) agreement between IAEA and NEA on a satisfactory way to avoid duplication of these two systems. These officials were concerned that the Soviet Union may receive IAEA reports without making a comparable contribution to the IAEA system. Therefore, to ensure a meaningful and reciprocal benefit for participation in the IAEA system, they believe that Soviet commitment to contribute in a meaningful way is essential before the NEA countries start routinely reporting incidents to IAEA.

NRC has pointed out that the U.S. and Soviet reactors are based on different technologies, so the usefulness and the applicability of the Soviet experience to U.S. reactors are small and the sharing of incident data may be relevant only in a generic sense, i.e., some operating procedures would still be comparable despite different technologies. However, NRC officials believe that it would not be equitable for them to provide the results of their costly analytical work to the Soviets without getting something in return. As shown in table 2, the Soviet Union in 1983 joined Bulgaria, Czechoslovakia, East Germany, and Hungary in agreeing to participate in the IAEA incident reporting system. The IAEA now expects the United States to join the system. However, the United States, wanting to assure that meaningful information is to be routinely exchanged, has taken a wait and see approach before notifying IAEA that it would become a participant. It should be noted that the United States has participated extensively in IAEA/NEA conferences and has exchanged technical reports on operational events with the IAEA through NEA.

At three meetings, IAEA and NEA have exchanged information on a small number of incidents. In a September 1983 meeting between IAEA and NEA, the Soviet Union for the first time reported a serious accident which occurred in 1982 at a nuclear power plant in Soviet Armenia. This incident involved a fire which caused the loss of both power plant controls and safety controls and seemed to have similarities to a fire which occurred in March 1975 at the Tennessee Valley Authority's nuclear power plant in Browns Ferry, Alabama.

To minimize duplication with the NEA system, NRC officials believe it would be desirable for IAEA to collect data from the

non-NEA countries, then exchange reports directly with NEA for their reports. However, NRC officials said they would be willing to consider any practice which could minimize the effort associated with two separate systems. Currently, the two organizations are working toward an agreement for routinely exchanging reports and for limiting distribution of some proprietary information. According to IAEA, the value of the system will depend on the willingness of governments to report information to other participating countries.

CONCLUSIONS

Through participation in the NEA incident reporting system and bilateral safety arrangements, the United States shares information on nuclear operating experience covering about 80 percent of the world's power reactors. Since the Three Mile Island accident, a substantial effort has been made to share information internationally. However, the United States does not share, on a bilateral basis, such information with Eastern bloc countries and some developing countries, although it widely reports operational information in a publicly available manner. The reverse is not true for Soviet bloc countries. Full participation by all nations with nuclear power programs would maximize the benefits of the incident reporting arrangements. Not only might the assessments of incidents in other countries be helpful to the U.S. government, industry, and the general public but also the enhanced systematic cooperation among scientists of various nations might benefit all parties to the cooperation.

The United States and some other countries of the Organization for Economic Cooperation and Development have made full participation in the IAEA incident reporting system contingent upon (1) a Soviet commitment to contribute information and (2) elimination of duplication between NEA and IAEA systems. Once these conditions have been met, there would be greater opportunities to share incident reporting information and to provide nuclear power plant operating data to countries which need it. The IAEA system, with full participation, would supplement the NEA system and broaden the exchange of information on operating incidents at nuclear power plants.

AGENCY COMMENTS

The NRC in commenting on a draft of this report said that the U.S. nuclear operating experience is well documented, available to the public, and assessed and characterized in numerous reports. However, the Soviet Union and other Eastern bloc countries do not provide full public disclosure on all significant operational events. Thus, they have access to U.S. information routinely, but the United States does not have access to their information.

The NRC also commented that the usefulness and applicability of the Soviet experience to U.S. reactors are small also because so little information is known about Soviet reactors and the information provided by the Soviet Union has been significantly limited. (See app. III.)

CHAPTER 5

EFFORTS TO ESTABLISH A FRAMEWORK FOR AN INTERNATIONAL RESPONSE TO NUCLEAR ACCIDENTS

Countries using nuclear power agree that problems resulting from a serious nuclear accident may be beyond the response capability of many countries and may require assistance from other countries. However, some constraints may complicate such assistance efforts; for example, State Department officials pointed out the need to resolve questions about the legal consequences of rendering assistance. The United States has tried to promote an international convention on this subject, but most countries are not ready to commit themselves to such a convention, according to U.S. officials. In the absence of a convention, according to U.S. officials, the IAEA member nations agreed to publish guidelines which could be used to facilitate assistance in the case of a nuclear accident.

EXTENT OF POTENTIAL ASSISTANCE NEEDED

Many countries believe they might require outside assistance in the event of a major radiation accident. The kinds and level of resources required to respond to a major accident was demonstrated at Three Mile Island. Substantial technical support and major commitments of resources were required on short notice to deal with the operational problems at the crippled reactor, to implement the plan for reactor cool-down, to manage the radioactive waste problem, and to develop the plan for long-term remedial actions. Reports on this accident showed that the number of on-site technical support people grew from 10 to almost 2,000 within 2 weeks. These technical people came from industry, government, research and educational institutions, and utilities. According to NRC's 1980 Annual Report, personnel from Italy, Japan, Spain, Switzerland, and Taiwan participated directly in recovery operations.[1]

It is clear that many countries would not have sufficient technical personnel to handle such an accident. In case of a similar accident abroad, the State Department has identified the following types of technical assistance that national governments might request from the United States.

--Diagnostic technicians.

---

[1]Numerous foreign reactor specialists also visited the site for discussions with NRC and plant representatives.

--Analytic and technical experts from laboratories, institutes, and reactor vendor organizations.

--Assistance from specialized institutes, such as the Nuclear Safety and Analysis Center of the Electric Power Research Institute and the Institute of Nuclear Power Operations.

--Communications and monitoring equipment.

--Material and safety equipment, such as graphite, filtration and waste handling equipment, and hydrogen recombiners.

--Helicopters which can be used with radiation monitoring crews and equipment.

OBSTACLES TO PROVIDING ASSISTANCE

The necessity to work out legal arrangements could impede the timely and effective provision of external assistance. According to State Department officials, several problems should be resolved in advance.

1. The issue of liability. Neither governments nor private entities would be willing to provide assistance in response to radiation accidents unless they were guaranteed immunity from potential claims arising from such assistance. For example, if an assisting party advised that a reactor operator take certain measures to alleviate the conditions at the reactor site or advised governmental authorities to take, or refrain from taking, certain off-site measures, that party may be subject to legal actions arising from consequences of implementing this advice. Absent such assurance, the officials doubt that any assistance would be provided internationally.

2. The nature of the privileges and immunities to be accorded to the assisting party and its personnel. The officials believe there is some concern that national or local subdivisions could attempt to tax equipment and material the assisting party brought into the jurisdiction of the requesting party. Further, to secure possible future judgments, orders of attachment could be sought against such equipment.

3. The question of who should control, direct, and supervise the personnel of the assisting party. Such personnel normally work for governments or private organi-

zations, but it is natural that a requesting party would wish overall control of any emergency assistance operation.

4. The question of expenses incurred by the assisting party and its personnel. Although it may appear obvious that a requesting party should be responsible for such expenses, disputes over what elements it should pay for and the terms of reimbursement could be an impediment.

The State Department also identified other legal questions.

--Does the country where the accident occurs have a duty to notify any other country of the accident?

--Under what conditions may or must the assistance be terminated?

--What information concerning the accident and the nature of the assistance provided may be made public?

IAEA experts identified the following additional concerns: commercial secrecy, political considerations, the unavailability of resources, logistics, customs, immigration, and other constraints arising from national and local laws and regulations. Such issues could impede the initial provision of emergency assistance. They could also cause substantial difficulty during the assistance operation, distracting governmental and assisting personnel from resolving problems caused by the nuclear accident.

INTERNATIONAL RESPONSE INITIATIVES

According to the State Department, it is possible to address such issues in advance, thereby overcoming the impediments to providing assistance. In 1981, the United States began an initiative to negotiate a convention setting forth the legal terms and arrangements that would apply to the provision of emergency assistance by one country to another in the event of a major nuclear accident. Some European nations expressed concern as to whether such a convention was needed and a compromise was worked out whereby in February 1982 the IAEA Board of Governors adopted a resolution submitted by the Netherlands, Sweden, and the United States calling for a group of experts to study the most appropriate means of responding to the need for mutual assistance. In response, 54 experts from 31 member nations and 2 international organizations met in June 1982. They adopted the substance of U.S. positions but recommended that the results

be contained in an information circular rather than a convention because development and acceptance of a convention could take considerable time. The experts recommended the prompt development of a reference document with a single set of provisions setting forth the terms and conditions that could be applied to emergency assistance and could (1) serve as a model for negotiating bilateral or regional agreements, which were to be encouraged, and (2) be available as a basis for agreement between a requesting and an assisting nation at the time of a nuclear emergency.

In January 1984, the IAEA published a set of Guidelines for Mutual Emergency Assistance Arrangements in Connection with a Nuclear Accident or Radiological Emergency. The guidelines apply to a situation where one country asks for help from another country or countries. No country is required to request, accept, offer, or provide assistance merely by reason of acceptance or use of the guidelines. The guidelines do not affect other legal arrangements or the right of countries to enter into different arrangements among themselves.

When emergency assistance is provided, the guidelines specify that overall control of and responsibility for the assistance in the requesting country rests with the requesting country. The guidelines recommend that countries identify and make known to each other and to the IAEA their competent authorities and points of contact having primary responsibility for coordinating operations in the event of a nuclear accident or radiological emergency. The IAEA maintains a list of these entities and disseminates it to its members.

The guidelines also provide that the requesting country should reimburse any assisting party for its costs, unless otherwise agreed among them. Further, an assisting party should be protected from liability that might arise out of the assistance rendered in the territory of the requesting country. In particular, the guidelines state that

> "an assisting party and entities and personnel acting on its behalf should not be liable for damage to or loss of any property, or damage to the environment, where caused by the nuclear accident or radiological emergency, or by any actions taken in rendering assistance that has been requested."

The guidelines further recommend that the requesting country afford personnel of the assisting party and personnel acting on its behalf the necessary privileges, immunities and facilities for the expeditious performance of their assistance functions.

IAEA documents show that the resources to respond to a major nuclear accident are not available in all regions. Thus, State Department officials believe that regional solutions alone will not be enough. These officials stated that the international community has the capability to put a legal framework into place in advance so that assistance could be given without such delays. However, the international community at large has not adopted this approach because some IAEA countries have been concerned about the issue of contingent liabilities and the length of time and effort to negotiate and ratify such a convention.

The IAEA has encouraged its member countries to enter into bilateral or regional assistance agreements with or without IAEA's participation. Through such agreements, countries can obtain technical services beyond their own individual resources. These agreements can also help to overcome problems in emergencies by providing channels of communication and arrangements relating to reimbursement of costs, liability, and other administrative matters. Two such agreements are the Nordic Mutual Emergency Assistance Agreement in Connection with Radiation Accidents[2] and the cooperative regional agreements of nations within the European Atomic Energy Community and some of their neighbors.

CONCLUSIONS

An impediment to outside assistance in the event of a radiation emergency would be the need to resolve certain legal issues in advance. U.S. officials indicated that the international community could put a legal framework into place in advance of an accident so that assistance could be given without delay. They believed greater cooperation could be achieved through an international convention, which would address some of the fundamental constraints already identified. However, other countries were content with the development of informational guidelines.

U.S.-designed reactors represent the majority of the power plants operating worldwide, so the United States would likely be called upon to assist other countries in the event of a major nuclear accident. It would, therefore, seem to be in the U.S. interest to eliminate, in advance, as many impediments as possible which would hamper or prevent bringing in U.S. expertise when needed to minimize the consequences of a major accident. Until or if the United States and other countries adopt an

[2]Denmark, Finland, Norway, and Sweden entered into this multilateral arrangement in 1963 under the auspices and with the participation of the IAEA.

international convention or some other legal framework on the issue, they can use the IAEA information circular as non-binding guidelines.

AGENCY COMMENTS

The State Department commented that U.S. efforts during 1981-84 made clear that the international community is not prepared at present to negotiate a global multilateral convention, particularly because of the perception held by many countries that such a convention would intrude into areas within their domestic jurisdiction, such as nuclear safety regulation. The State department sees no prospect of an imminent change in this situation.

The State Department believes that the substance of the U.S. proposal for a multilateral convention are reflected in the guidelines published by IAEA in 1984. Further, State believes that if the relevant U.S. agencies are familiar with the guidelines and urge that assistance in response to a nuclear accident or radiological emergency hinge on prior acceptance by the recipient of the terms and conditions in the guidelines, their interests and those of the United States will be fully protected.

APPENDIX I

SYSTEMS IN NUCLEAR POWER REACTORS IN OTHER COUNTRIES WITH SIGNIFICANT OR POTENTIALLY SIGNIFICANT SAFETY INCIDENTS SINCE 1971

	Number of occurrences
Main steam supply systems	22
Coolant recirculation systems and support	22
Reactivity control systems	17[a]
On and/or off-site power systems	14
Emergency core cooling systems	13[a]
Residual heat removal systems	11
Condenser and feedwater systems	10
Reactor vessel integrity and operability	8
Emergency generator systems	7
Reactor core systems	5
Containment systems and control	5
Spent fuel and waste management systems	7
Turbine generator systems	4
Fuel handling systems	2
Other	4
Total	151

[a]Includes one "significant" safety incident.

Source: Compiled from NRC's Foreign Event File.

United States Department of State

Comptroller

Washington, D.C. 20520

May 6, 1985

Dear Frank:

I am replying to your letter of April 3, 1985 to the Secretary which forwarded copies of the draft report: "International Response to Nuclear Power Plant Safety Concerns".

The enclosed comments on this report were prepared in the Bureau of Oceans and International Environmental and Scientific Affairs.

We appreciate having had the opportunity to review and comment on the draft report. If I may be of further assistance, I trust you will let me know.

Sincerely,

Roger B. Feldman

Enclosure:
As stated.

Mr. Frank C. Conahan,
Director,
National Security and
International Affairs Division,
U.S. General Accounting Office,
Washington, D.C. 20548

GAO note: Where appropriate, we revised the report to note State's specific comments.

GAO DRAFT REPORT: "International Response to Nuclear Power Plant Safety Concerns"

The various offices within the Department of State have major substantive comments only with respect to the basic issue of whether the IAEA guidelines should be used as the basis for an effort to negotiate an international convention dealing with reactor safety issues and technical assistance. Our remarks are as follows:

Chapter V of the draft report presents a fair summary of the Department's efforts to establish an international framework to deal in advance with obstacles to the provision by one nation to another of assistance in dealing with a nuclear accident or radiological emergency. Our efforts in 1981-1984 made clear that the international community is not prepared at present to negotiate a global, multilateral convention on this subject, particularly because of the perception held by many states (which the U.S. did not share) that such a convention would intrude into areas within their domestic jurisdiction, such as nuclear safety regulation. We see no prospect of an imminent change in this situation.

The substance of the United States proposal for a convention has been reflected in the Guidelines published in 1984 (INFCIRC/310). If the relevant U.S. agencies familiarize themselves with the Guidelines and insist that any assistance they provide to a foreign nation in response to a nuclear accident or radiological emergency be conditioned on the prior acceptance by the proposed recipient of the terms and conditions in the Guidelines, their interests and those of the United States will be fully protected. The Guidelines explicitly recognize that they can be utilized on an agreed, ad hoc basis, and the U.S. has already proposed their use in one case. When used in this way, they constitute an appropriate legal regime for assistance. The Department does not believe it would be possible to negotiate terms more favorable for the United States in a multilateral convention. We disagree with the conclusion that the United States should, at the present time, undertake efforts to negotiate a convention based on the Guidelines. (See GAO note.)

In addition to these remarks, we would like to suggest a few minor revisions. On page 29 certain figures are inaccurate. The percentage breakdown for funding in the first paragraph should be 80% for the US and 20% for other countries. The total figure in dollars should also be changed to $92 million. (now p. 18)

GAO note: GAO did not conclude in its draft report that the United States should undertake efforts to negotiate a convention based on the guidelines.

APPENDIX II

(now p.21) The reference to OES at the bottom of page 33 should be deleted and replaced with a more specific reference to "The State Department's Director of Energy Technology Cooperation." Immediately following this new language proposed for page 33, insert the phrase"....in coordination with the US Member of the NEA Steering Committee,"...

On the same page in the second paragraph, insert after the reference to IO Bureau the following phrase: "....in coordination with the US Representative to the IAEA."

Assistant Secretary of Oceans
and International Environmental
and Scientific Affairs

APPENDIX III

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 3, 1985

Mr. J. Dexter Peach
Director, Resources, Community, and
Economic Development Division
U.S. General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Peach:

Thank you for the opportunity to comment on the draft GAO report entitled "International Response to Nuclear Power Reactor Safety Concerns."

I would like to bring to your attention three general comments and four specific ones.

General

1. The draft GAO report contains NRC foreign proprietary material (pp. ii, 14-16, 41, and Appendix I) which has already been identified as sensitive by several of NRC's information exchange partners. This material must either be deleted in entirety or the GAO report labelled and protected as "proprietary" because publication of the materials "as is" could seriously compromise NRC's ability to obtain this type of information in the future. It would also violate NRC's information dissemination agreements with the NEA, the IAEA, and the individual countries under which this material was collected in the first place.

(now pp. 9, 10,35)

2. The information on the current approach to, and the status of, the IAEA-NEA exchange of incident reports has been updated (see attachment) to more accurately reflect the situation as of April 1985.

3. The draft report covers two related but separate topics which we believe should be more clearly delineated: (a) the sharing of safety-related information, including operating experience of nuclear power plants, and (b) international response to a nuclear power plant accident.

Specific

4. Page 38, Table indicating IAEA-IRS participants.

The U.S. should be shown under the category of full participation with a subscript "a" since the type and degree of participation has been the same as Belgium, FRG, France, Italy, Japan, The Netherlands, Spain, and Sweden. As noted earlier, the U.S. has exchanged technical reports on operational events with the IAEA through the OECD/NEA and has participated extensively in international IAEA/NEA conferences. (See GAO note.)

(now p. 24)

GAO note: According to IAEA, the United States is expected to become a full participant in the IAEA incident reporting system but has not yet notified the international organization that it intends to do so. For current IAEA listing, see p. 24.

5. Page 41, first full sentence.

(now p. 26) The draft report fails to make the point that the usefulness and the applicability of the Soviet experience to U.S. reactors are small because: (1) of the differences between the U.S. and Soviet reactors; (2) so little information is known about the Soviet reactors; and (3) the information provided by the Soviet Union on operational events is significantly limited.

6. Page 41, last sentence, second paragraph.

(deleted from final report) To the best of NRC's knowledge, the statement that the reactor in question was "running uncontrolled at full power" is inaccurate and should be either deleted from the text (if the decision is made to remove all proprietary information) or substantially modified (if the decision is to restrict the report).

7. Page 42.

(now pp. 25) The draft report does not properly indicate that the U.S. widely reports operational information in a publicly available manner. U.S. experience is well documented, available to the public, and assessed and characterized in numerous reports. The reverse is not true; for example, the Soviet Union and other Eastern Bloc countries do not provide full public disclosure on all significant operational events. Thus, they have access to our information routinely, but we do not have access to their information.

A copy of the draft report annotated with additional minor comments is attached.

Sincerely,

William J. Dircks
Executive Director for Operations

Attachment:
Annotated Text, Report by the U.S. GAO, "International Response to Nuclear Power Reactor Safety Concerns" (Proprietary Information)

GAO note: NRC's specific comments have been incorporated throughout the body of the report where appropriate.

(488115)

Requests for copies of GAO reports should be sent to:

U.S. General Accounting Office
Post Office Box 6015
Gaithersburg, Maryland 20877

Telephone 202-275-6241

The first five copies of each report are free. Additional copies are $2.00 each.

There is a 25% discount on orders for 100 or more copies mailed to a single address.

Orders must be prepaid by cash or by check or money order made out to the Superintendent of Documents.

3480

AN EQUAL OPPORTUNITY EMPLOYER

UNITED STATES
GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

OFFICAL BUSINESS
PENALTY FOR PRIVATE USE $300

BULK RATE
POSTAGE & FEES PAID
GAO
PERMIT No. G100